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ABSTRACT

The purpose of this study was to evaluate the appropriateness and effectiveness of current high school mathematics curricula for students in technical and vocational education programs. Students in 21 Wisconsin high schools were surveyed; administrators and chairmen of mathematics departments in these schools were also interviewed. Results indicated that most schools require one course in mathematics for graduation, although schools are reevaluating the requirement. The majority of schools were interested in developing programs in vocational and technical mathematics. Some schools claimed to serve vocational students by courses in the college preparatory or general mathematics sequences. Tables showing numbers and percentages of students pursuing different high school programs and taking different mathematics courses are provided. Eight recommendations for the development of a program in mathematics for vocational and technical students are offered. (SD)

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FINAL REPORT

Project No. 15.034.151.221

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EVALUATION OF SECONDARY MATHEMATICS CURRICULUMS IN DISTRICT 15 AS THEY RELATE TO THE MATH BACKGROUND REQUIREMENTS OF POST-SECONDARY VTAE STUDENTS

AUGUST, 1971

NORTH CENTRAL TECHNICAL INSTITUTE
WAUSAU, WISCONSIN 54401

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Wausau, Wisconsin

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August, 1971

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PREFACE

This study is not intended to be the last or only word in vocational-technical mathematics in secondary schools of District Fifteen. It does not attempt to answer all the complex problems relating to the existing general math programs nor does it offer a magical panacea for the development and implementation of a comprehensive vocational technical math program.

Perhaps, in its most optimistic sense, this brief study might become a focal point about which we, who are concerned with vocational-technical mathematics, can begin to rally. Comprehensive vocational-technical mathematics programs in District Fifteen will not evolve by themselves. Therefore, we who are concerned must be purposeful, and we must act together if we hope to develop a program that will meet the needs of students who plan to enter vocational and technical fields.

Lawrence Kaffine

INTRODUCTION

It is an unfortunate truism that in America the role of vocational and technical education has never been fully understood by a great many secondary educators and that it too often has been offered not as an educational opportunity but as a solution to the problem of what to do with students who cannot succeed in the academic curriculum. It is then no surprise that though obviously the same kind of education is not equally appropriate for all, many secondary educators still pursue with great vigor the American ideal of a college education for all. Perhaps the ideal is a natural consequence when one considers that our society is "degree conscious" and that secondary educators are products of baccalaureate institutions.

It is not, however, the purpose of this study to seek out the problems of widespread indifference and the lack of understanding displayed by secondary educators concerning vocational and technical education. What we are primarily concerned with is an attempt to determine the adequacy of secondary mathematics curriculums in District Fifteen, and to reveal the basic mathematical needs of those students who aspire to vocational and technical education, and the degree to which secondary schools are meeting these needs.

Problem

The adequacy of vocational-technical mathematics curriculums in the secondary schools of District Fifteen is the specific problem under research.

The "in" mathematics curriculum of today is "modern" and theory-oriented. It is designed primarily to meet the needs of those students who have college aspirations. Little, if any, emphasis is placed upon the needs of the average, below average, and non-college-aspiring students.

The problem is not peculiar to District Fifteen, for anyone knowledgeable in secondary math curriculums realizes that the problem exists throughout the state, primarily but not exclusively in the rural areas.

Objectives

The primary objective of this study is an evaluation of the secondary school mathematics curriculums in District Fifteen. Such an evaluation will be in terms of the needs of those students who plan to enter vocational and technical fields.

A compilation of all relevant materials concerning the study will be distributed to all participating schools.

Secondary objectives of the study are:

A. Establish avenues of communication between the Math Department of NCTI and the secondary schools in District Fifteen.

B. Provide an opportunity for secondary schools to expound on their positions and problems involved in implementing a math curriculum which is vocational-technical oriented.

C. Provide an opportunity for NCTI to help identify the strengths, weaknesses, and deficiencies of the vocational-technical math curriculums of participating schools.

D. Enable the participating schools to gain first-hand information concerning the nature of the math curriculum at NCTI and what the Math Department of NCTI expects of students who plan to enter its math program.

E. Provide the Math Department of NCTI with an opportunity to evaluate its own curriculum in light of the newly acquired research material.

The evaluation of the secondary curriculums should be completed during the summer of 1971. The secondary objectives can only be realized to their fullest potential if the study is continued into the 1971-72 school year.

METHODOLOGY

The evaluation of math curriculums was done primarily by personal interviews with personnel who are responsible for curriculum development; that is, chairmen of math departments and high school administrators. Information on the number and kind of math courses completed by the high school seniors during the past four years was acquired by having them complete the Mathematics Profile Survey form (Appendix B). Information on the number and kind of high school math courses completed by NCTI students who were in the third and fourth semester of a two year program and in second semester of a one year program was acquired by having them complete the NCTI Math Survey form (Appendix C).

The following schools were visited and personal interviews were conducted. Department chairmen were given the math survey forms and were asked to have them completed and returned to NCTI as soon as possible.

Abbotsford	Newman (Wausau)
Antigo	Park Falls
Athens	Phillips
Colby	Rib Lake
D. C. Everest (Schofield)	Rosholt
Edgar	*Shawano
Loyal	Stratford
Marathon	Wausau East
Medford	Wausau West
Merrill	Wittenberg-Birnamwood
Mosinee	**

* District Thirteen
** Spencer and Prentice did not participate in the study.

One hundred percent of the above listed schools returned the math survey forms completed by their seniors.

No attempt was made to evaluate the academic or college oriented math courses.

FINDINGS-AN ANALYSIS

This study involved 21 secondary schools and 2,675 seniors, approximately 81% of a total enrollment of 3,315.

Let me begin by stating that secondary schools realize that there are deficiencies in their existing math programs and that modern math apparently does not live up to all of its great expectations. Obviously it is good math for the college prep student - no one seemed to question that; but, there definitely is uneasiness as to how well it is meeting the needs of the non-college-oriented students. A majority of the department chairmen indicated they are unhappy with the general math situation and that they desired assistance, particularly as to what materials and texts were available for this group. The frustrations of the secondary math teachers are borne out by their fragmentary or piecemeal approach in meeting the needs of the non-college group. Schools throughout the District are introducing two year Algebra I courses and new general math courses. They are also dropping or revising some of the old general math courses, and in some instances just giving them new names. Along with the conglomeration of the courses there still remains the archaic one-math-credit requirement for graduation. It must be noted that even the one-credit requirement is changing. Some schools are now requiring two credits, and still

others plan on having no math requirement at all. This then is the state of general mathematics, a state best described as one of general confusion. It is not too surprising that the respective math chairmen are looking for better things to come, for general math must either be replaced or improved upon.

The majority of schools in District Fifteen, I believe, are ready and willing to accept some kind of vocational-technical math program. They are interested, and several have shown great desire to revise their existing programs by giving more consideration to those students who are not college oriented. Presently, vocational-technical mathematics curriculums on a formal basis, with the exception of Mosinee, do not exist in the high schools of this District. In some instances, they may exist by implication of the courses offered. For example, some schools do offer courses in business math, consumer math, computational and practical math; or in other instances, some schools consider vocational-technical math as part of the college prep program. These claims of the existence of a vocational-technical program, however, are without foundation, and my original statement still stands.

Developing and implementing a comprehensive vocational-technical math program, unfortunately, is not an easy task. Administrators of any joint venture made by technical institutions and secondary schools should bear in mind that such an undertaking

is indeed formidable. The development of a comprehensive program is a topic which will be treated later in the Recommendations section of this study.

Since 411 students, or about 15% of the 2,675 students surveyed, indicated an interest in technical education, it behooves us to examine in detail the existing math programs.

First, let us attempt to identify the mathematical needs of a student who plans to enter a vocational and technical institution. Having identified these needs, let us determine whether or not they have been met by the secondary schools.

Contrary to what many secondary educators might believe, the needs of a vocational-technical student go far beyond general mathematics. According to Table II, the average successful student at NCTI has had at least two courses of high school math. Also as indicated, and as would be expected, the needs of a one year diploma program differ substantially, .8 of a course, from that of an associate degree program.

Table I, A,B,C,D, indicates the amount of mathematics desirable for students who plan to enter specific programs at NCTI. In the Electronics and Mechanical Design programs, three credits of math are recommended. Automotive Technology and Residential Design also require a strong background in math. It is interesting to note that for Electronics Servicing, a one year diploma program, at least two credits is recommended.

NCTI MATH SURVEY

Table I - A

NCTI math survey for third and fourth semester students in two year programs and second semester students in one year programs. Second semester 1971.

	Electronics Two Year Associate Degree Program	Residential Design Two Year Associate Degree Program	Automotive Technology Two Year Associate Degree Program	Marketing Two Year Associate Degree Program
1 Number of students that completed survey	31	26	25	33
2 Total number of high school courses taken in item one	90	66	59	76
3 Average courses per student item two / item one	2.9	2.5	2.4	2.3
4 Number of math courses taken by the individual students in item one	Courses - Students 4 - 9 3 - 14 2 - 4 1 - 4 0 - 0	4 - 3 3 - 10 2 - 11 1 - 2 0 - 0	4 - 4 3 - 6 2 - 10 1 - 5 0 - 0	4 - 3 3 - 13 2 - 8 1 - 9 0 - 0
5 Kinds of math courses taken by the students in item one.	General Math - 0 Business Math - 0 Algebra I - 31 Geometry - 27 Algebra II - 23 Trigonometry - 2 Advanced Math - 7	0 0 26 24 13 2 1	4 2 23 17 9 4 0	5 1 32 22 13 1 2

NCTI MATH SURVEY

Table I - B

	Mechanical Design Two Year Associate Degree Program	Machine Tool Operation Two Year Diploma Program	Insurance Two Year Associate Degree Program	Electronics Servici One Year Diploma Program
1	18	23	5	20
2	53	51	11	44
3	2.9	2.2	2.2	2.2
4	4 - 6 3 - 6 2 - 5 1 - 1 0 - 0	4 - 4 3 - 7 2 - 2 1 - 10 0 - 0	4 - 1 3 - 0 2 - 3 1 - 1 0 - 0	4 - 1 3 - 6 2 - 9 1 - 4 0 - 0
5	0 0 18 17 11 4 3	8 1 19 12 8 0 3	0 0 5 4 1 1 0	5 0 17 14 5 1 2

NCTI MATH SURVEY

Table I - C

Agricultural Mechanics Two Year Diploma Program	Secretarial Science Two Year Associate Degree Program	Home Economics One Year Diploma Program	Merchandising One Year Diploma Program	Welding One Year Diploma Program
11	14	20	12	14
22	30	35	21	23
2	2.1	1.8	1.8	1.7
4 - 2 3 - 1 2 - 4 1 - 3 0 - 1	4 - 1 3 - 3 2 - 7 1 - 3 0 - 0	4 - 0 3 - 2 2 - 11 1 - 7 0 - 0	4 - 0 3 - 2 2 - 6 1 - 3 0 - 1	4 - 1 3 - 2 2 - 4 1 - 5 0 - 2
1 0 10 6 3 1 1	1 1 13 10 4 1 0	5 2 18 10 0 0 0	3 1 9 7 1 0 0	6 1 9 4 2 1 0

NCTI MATH SURVEY

Table I - D

Farm Machinery Partsman One Year Diploma Program	Mechanical Drafting One Year Diploma Program	Printing Two Year Diploma Program	Clerk-Typist One Year Diploma Program	
12	13	10	13	
18	18	13	16	
1.5	1.4	1.3	1.2	
4 - 0 3 - 2 2 - 2 1 - 8 0 - 0	4 - 0 3 - 0 2 - 7 1 - 4 0 - 2	4 - 0 3 - 1 2 - 2 1 - 6 0 - 1	4 - 0 3 - 2 2 - 2 1 - 6 0 - 3	
8 0 5 4 1 0 0	7 0 7 4 0 0 0	7 0 5 1 0 0 0	2 1 9 2 2 0 0	

NCTI MATH SURVEY

Table II

Average number of math courses per student for diploma and associate degree programs. Second semester 1971.

	Total number that completed survey	Total number of high school math courses taken	Average courses/student
One Year Diploma Program			
Home Economist Clerk-Typist Electronics Servicing Merchandising Mechanical Drafting Welding Farm Machinery Partsman	104	175	1.7
Two Year Diploma Program			
Agricultural Mechanics Machine Tool Operation Printing	44	86	2
Two Year Associate Degree Program			
Residential Design Automotive Technology Electronics Mechanical Design Secretarial Science Marketing Insurance	152	385	2.5
TOTALS	300	646	2.1

Welding, a one year diploma program for which many educators might suspect a light preparation is all that is necessary - requires 1.7 math credits as indicated by Table I. Table I also indicates more than one credit of math is desirable for all the programs surveyed at NCTI.

Table III indicates the particular high school math courses taken by successful NCTI students. While no hard and fast conclusions can be made, certainly one can draw some interesting generalizations. First, a student with no math has little chance of success at our institution. Second, four of five successful students at our institution have had Algebra I. Third, on the assumption that geometry follows Algebra I, over half of the successful students at our institution have had both Algebra I and Geometry.

Table III also puts the general math problem in its proper perspective. With only 21% of the successful students taking general math, and with Table I indicating that more than one credit is desirable for all the programs surveyed, it would be fair to state that general math in itself is not adequate preparation for a vocational and technical institution.

To conclude, the mathematical needs of students who plan to enter vocational and technical fields are much greater than most secondary educators would care to believe. A strong background, three or more credits, is highly recommended for some

Table III

Tabulation of figures found in items 4 and 5 of Table Two.

COURSE	NUMBER OF STUDENTS	PERCENT BASED ON 300 RETURNS
General Math	62	21%
Algebra I	256	86%
Geometry	185	61%
No Math	10	3%

From the above results several generalizations can be made.

One: General Math in itself is not adequate preparation for the Vocational-Technical Institute.
Two: Four of every five successful students at the Institute have had Algebra I.
Three: On the assumption that Geometry follows Algebra I, over one-half the successful students at the Institute have had both Algebra I and Geometry.
Four: A student with no Math has little chance of success at the Institute.

associate degree programs. A moderate background, two or more credits, is recommended for the one and two year diploma programs. The general Math I credit terminal course is not acceptable for it cannot be considered adequate preparation for vocational and technical education.

Having determined some of the basic mathematical needs of the vocational and technical student, let us now consider just how successful secondary schools have been in meeting them. Have the schools of District Fifteen encouraged their students to consider careers in vocational and technical fields by offering a variety of math courses, or have they been indifferent to student needs by offering a stunted and unimaginative math program. Of twenty-one schools surveyed, six, all rural, offered a four year college prep program with one year of general math. One senior high school consisting of grades ten through twelve, does not offer any courses that can be considered non-college oriented. Of the fourteen remaining schools, a majority of them offer the usual general math and a second course of business, consumer, and senior math. The latter are really irrelevant since most of them are still basically arithmetic courses, some of which are designed primarily to keep the students busy. The above, I believe, represent in various degrees programs that are stunted, unimaginative, and indifferent to the needs of the vocational and technical student.

To those who claim Algebra I is also for non-college students, I respond by stating that it would pretty much depend upon the text being used. For example, the popular Houghton Mifflin Series Algebra I text cannot be considered non-college by any stretch of the imagination.

On the positive side of the ledger, there are several schools that have, or will have this coming school year, two-year Algebra I courses. Such courses are excellent. Not only do more students have an opportunity to succeed in basic algebra, but also the concept of a sequence is being developed outside of the college prep program. This is of utmost importance in the development of any kind of vocational technical math program. In one other area, that of remedial math, progress is also being made. There are schools in the District that are identifying remedial math as such and are not attempting to hide remedial courses in the general math program. This too is very important for if a vocational-technical math program is to be successful, it must be divorced from remedial math.

Let us now turn to the issue of math preparation for those students who plan to enter vocational and technical schools. As indicated previously, two credits are recommended for the diploma programs and three credits are recommended for some of

the associate degree programs. Are the secondary schools, with their college oriented programs, adequately preparing the potential vocational-technical student? At first glance, the answer would appear to be a weak yes for the average preparation, Table IV, is 2.3 courses. Such preparation would be adequate for the diploma programs, and though a bit deficient, certainly could not be considered completely inadequate for the associate degree programs. However, I suspect that many of the students in this group represent "dropouts" from the college prep program; consequently, they are in the technical column by accident and not by design. They don't really represent the technical group but certainly influence it by virtue of being previously in the college prep math program.

Perhaps some would say my reasoning is faulty and that 2.3 credits is accurate. So be it. Nevertheless, let us continue to pursue this issue still further and relate it to the data in Table VI. This table indicates that only 15% of the students surveyed were interested in technical education. It would appear then that although preparatory courses offered by the schools could be considered adequate, the number of students being prepared is definitely inadequate. That is to say, 15% of a total student population entering technical education is just unrealistic when one considers that we live in a society that is technology oriented.

It is also interesting to note that the total percent of the two and four year college columns is double that of the technical. This too is unrealistic but it does lend credence to my earlier statement that secondary schools still pursue the college ideal vigorously.

Before concluding this issue of math preparation, I would like to make some comments concerning the Seek Employment column of Table IV. Here the average math preparation is 1.8 credits. Many of the students in this group will eventually enroll at a technical institute or attend classes there on a part time basis. They are students who have no particular objective in mind. Some have full time work, others part time, all getting their feet wet in the labor market. They soon realize that their opportunities are limited unless they further their education on a formal or informal basis. Upon entering an institution such as NCTI, many of these students find themselves in our Prep Program. This is a no credit program which enables students to make up some of their deficiencies. In mathematics, we offer courses in arithmetic review and basic algebra. This is necessary because their chances of success would be small indeed without such special preparation. The 1.8 average math preparation is not adequate. It is not realistic preparation for young people who plan to enter a highly competitive labor market. Two credits of math should be required of all graduating seniors.

TABLE IV
MATH BACKGROUND OF HIGH SCHOOL
STUDENT RELATED TO FUTURE PLANS

SCHOOL	4-YEAR COLLEGE NO.	4-YEAR COLLEGE PCNT	AVERAGE MATH PREPARATION	TECHNICAL INSTITUTE NO.	TECHNICAL INSTITUTE PCNT	AVERAGE MATH PREPARATION	SEEK EMPLOYMENT NO.	SEEK EMPLOYMENT PCNT	AVERAGE MATH PREPARATION
Abbotsford	18	38	3.6	3	6	2.7	13	28	1.5
Antigo Senior High	78	30	2.9	34	13	1.9	61	23	1.6
Athens High School	12	19	2.7	9	14	2.1	19	30	1.7
Colby Public Schools	20	18	3.1	25	23	2.5	36	33	1.9
D. C. Everest	38	21	2.8	34	18	2.3	48	26	2.0
Edgar	15	38	3.3	9	23	2.7	7	18	1.7
Loyal High	18	26	3.1	23	33	2.7	5	7	1.8
Marathon High	11	15	3.4	15	21	2.5	24	33	1.9
Medford Senior High	32	17	3.3	36	20	2.2	38	21	1.6
Merrill Senior High	53	21	2.9	33	13	2.4	68	28	1.6
Mosinee High	27	23	3.2	24	20	2.0	31	26	1.6
Newman	59	46	3.3	11	9	3.2	14	11	2.4
Park Falls High	19	21	3.5	19	21	2.4	30	33	1.9
Phillips High School	36	36	2.8	20	20	2.0	22	22	1.1
Rib Lake High	11	19	3.4	6	10	2.7	18	31	1.8
Rosholt	5	12	2.6	5	12	2.2	10	24	2.2
Shawano High	70	37	3.2	27	14	2.8	41	22	2.1
Stratford	17	23	2.8	14	19	2.5	18	25	2.1
Wausau East High	104	44	3.0	16	7	2.3	29	12	1.6
Wausau West High	79	27	3.0	37	13	2.1	57	20	1.7
Wittenberg-Birnamwood	18	21	3.3	11	13	1.9	29	35	1.6
Totals and Total averages	740	28	3.1	411	15	2.3	618	23	1.8

TABLE V

MATH BACKGROUND OF HIGH SCHOOL STUDENTS

SCHOOL	STUDENTS WITH 1 MATH COURSE NO.	PCNT	STUDENTS WITH 2 MATH COURSES NO.	PCNT	STUDENTS WITH 3 MATH COURSES NO.	PCNT
Abbotsford	12	26	10	21	8	17
Antigo Senior High	86	33	94	36	61	23
Athens High School	17	27	29	46	12	19
Colby Public Schools	23	21	43	39	34	31
D. C. Everest	37	20	81	44	42	23
Edgar	8	20	10	25	9	23
Loyal High	3	4	32	46	16	23
Marathon High	13	18	34	47	17	23
Medford Senior High	59	32	66	36	33	18
Merrill Senior High	64	26	99	40	60	24
Mosinee High	39	33	35	30	22	19
Newman	1	1	33	26	52	41
Park Falls High	19	21	38	41	12	13
Phillips High School	41	41	28	28	22	22
Rib Lake High	14	24	22	37	8	14
Rosholt	2	5	32	78	6	15
Shawano High	19	10	60	32	64	34
Stratford	10	14	36	49	18	25
Wausau East High	44	19	74	31	64	27
Wausau West High	70	24	93	32	85	30
Wittenberg-Birnamwood	30	36	28	33	10	12
Final TOTALS and Total Averages	611	23	977	36	655	24

Table VI

VTAE DIST. 15 STUDY OF GRADUATING HIGH SCHOOL SENIORS
PLANS FOR FALL - 1971
Conducted April and May 1971

High School	No. of Seniors	No. of Replies	Seek Employment		Military Service		4 Year College		2 Year College		Technical Institute		Other School		Homemaker		Plans Not Definite		Other		Multiple Reply	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Abbotsford	47	47	13	28	2	4	18	38	1	2	3	6	2	4	1	2	3	6			4	9
Antigo	332	264	61	23	14	5	78	30	4	2	34	13	3	1	6	2	40	15	2	1	22	8
Athens	70	63	19	30	1	2	12	19	3	5	9	14	4	6	1	2	11	17	1	2	1	2
Colby	115	110	36	33	5	5	20	18	5	5	25	23	3	3			13	12	1	1	2	2
D. C. Everest	262	184	48	26	3	2	38	21	7	4	34	18	4	2	4	2	25	14	2	1	19	10
Edgar	76	40	7	18	2	5	15	38			9	23	2	5			4	10			1	3
Loyal	88	70	5	7	4	6	18	26	2	3	23	33	2	3	1	1	12	17	2	3	1	1
Marathon	77	73	24	33	3	4	11	15	2	3	15	21	2	3			11	15	1	1	4	5
Medford	208	184	38	21	18	10	32	17	10	5	36	20	9	5	1	1	31	17	6	3	3	2
Merrill	275	247	68	28	15	6	53	21	10	4	33	13	7	3	4	2	33	13	5	2	19	8
Mosinee	126	118	31	26	11	9	27	23	5	4	24	20	5	4			8	7			7	6
Newman	162	127	14	11	2	2	59	46	19	15	11	9	4	3	1	1	5	4			13	10

Table VI

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High School	No. of Seniors	No. of Replies	Seek Employment		Military Service		4 Year College		2 Year College		Technical Institute		Other School		Homemaker		Plans Not Definite		Other		Multiple Reply	
			No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Park Falls	97	92	30	33	5	5	19	21	1	1	19	21	2	2			10	11	2	2	4	4
Phillips	104	102	22	22	1	1	36	35			20	20	1	1	1	1	13	13	6	6		
Rib Lake	59	59	18	31	4	7	11	19			6	10	5	8	4	7	9	15	1	2	1	2
Rosholt	44	41	10	24	6	15	5	12	1	2	5	12	1	2			5	12	2	5	6	15
Shawano	230	167	41	22	4	2	70	37	6	3	27	14	5	3	3	2	15	8	3	2	13	7
Stratford	90	73	18	25			17	23	2	3	14	19	5	7	1	1	7	10	4	5	5	7
Wausau East	340	238	29	12	5	2	104	44	22	9	16	7	4	2	2	1	19	8	3	1	32	13
Wausau West	400	272	57	21	6	2	79	29	23	8	37	14	3	1	3	1	39	14	5	2	36	13
Wittenberg-Birnamwood	111	84	29	35	5	6	18	21	2	2	11	13	3	4			12	14	1	1	3	4
Total Senior Plans	3315	2675	618	23	116	4	740	27	125	4	411	15	76	2	33	1	325	12	47	1	196	7

A final issue to be considered is that of requiring only a single math credit for graduation. Of twenty-one schools surveyed (Appendix A) two schools required no credits, two schools required two credits and seventeen schools required one credit. The one or zero math credit requirement is completely inadequate. The disastrous results of such a requirement is clearly indicated in Table V. Five schools graduated about one-third of their seniors with one credit. In one school, two of every five seniors had only one credit of math. For the entire District, 611 students or about 23% of those surveyed graduated with only a single course of math, and, to add insult to injury, bear in mind that a majority or more of these students had that single course in their freshman year. I do not know the rationale behind the one credit requirement but whatever it is, it should be reconsidered as soon as possible. Our complex technological society can no longer afford the luxury of sending out each year from the secondary schools thousands of young people untrained in the basic fundamentals of mathematics.

CONCLUSION AND RECOMMENDATIONS

Are the secondary schools of District Fifteen meeting the needs of those students oriented to vocational and technical fields? The answer to that question, based on the data included herein, is no. There are no formal vocational-technical programs, with one exception, in this District. The programs that do exist are college-oriented and anything left over euphemistically called general math, consists of two unrelated courses. The general math program is adequately described as stunted and unimaginative. Since secondary schools continue to emphasize their college programs, an unrealistic figure of 15% of the students surveyed indicated an interest in technical education - a figure that is certainly not in line with a society oriented to technology. Finally, about one in every four seniors in the district graduated with only a single credit of math. This too is an intolerable situation, it is a luxury our society can ill afford.

My recommendations, like this study, will be limited and in no sense should be considered all-inclusive. They are, in general, not original and many of them have been discussed by concerned teachers, counselors and administrators on numerous occasions. Although I do propose to slay several sacred cows, I am not prepared at this time to administer the coup de grace to "modern math".

Education is an evolutionary process; vocational-technical math programs are not going to be developed overnight. In recognition of this, let us first consider how we can improve the already existing general mathematics programs.

An administrative philosophy prevalent in secondary schools is "anyone can teach general math". As a result, the most competent math teachers are scheduled into the college prep courses and all others; the novices, the indifferent, the uninformed, and the incompetent will teach the remaining general math courses. The latter group includes the chemistry, physics, and business education teachers, all substitutes, as well as the administrator himself. And, since general math is so easy to teach, the teachers are often loaded down with large classes, inadequate teaching aids and equipment, and a wide variety of students some of whom are behavioral problems. The latter are "guided" into general math classes because not only can anyone teach general math but also "anyone can learn general math". The result of this unhappy situation is that most teachers are eager to move up to the college prep courses. Even the most dedicated and talented soon realize there is no future in bucking the system and they too leave the ranks of general math teachers. General mathematics on the secondary level continues to be a dirty word. It connotes deficiencies of all kinds along with indifferent, incompetent and novice teachers.

If we are to improve the general math program, we must first challenge the philosophy "anyone can teach general math" for this simply is not true. Some soul-searching must be done by administrators who must face up to the fact that "anyone" just can't do the job and that it is unfair to a great number of students if schools continue to staff the general math classes with second best teachers. A good knowledge of subject matter is not the only criteria by which a teacher is selected for a particular course. Granted it is necessary, but other characteristics must be given due consideration. Is the teacher enthusiastic or does he just go through the motions of teaching? In a college prep course, such a teacher could be reasonably successful. In a general math course, however, he would be an utter failure. Does the teacher have a sense of humor, is he patient, and is he so knowledgeable as to present his material in a concrete, specific manner which will be interesting to the students. Is he familiar with the basic tenets of the psychology of learning and is he acquainted with the characteristics of average and below average learner? My criteria, perhaps, is too idealistic. However, I submit that many of these characteristics can be found in the college prep teachers whose presence in the general math classroom a portion of the school day would do much for the general math program. In conclusion, it is unfair to monopolize the best

teachers throughout the day with college prep courses. If the administrators wish to strike a first blow for general math, let them schedule these teachers into general math classes at least a small portion of the school day.

Let us now consider the issue of one credit of math for graduation and the general math terminal course concept. Under this system usually all of the students take either general math or algebra their first year in high school. One result of this program is that a great many seniors are graduating who have had little or no math the last two or three years of school. When the members of this group attempt to enter the military, vocational and technical institutions, or the labor market, they are stymied and soon realize that opportunities are limited because of their deficiencies in mathematics. Why must this general math course be mandatory at the ninth grade level. Why not make it optional up to grades eleven and twelve and mandatory for grade twelve if a senior has had no math in the previous three years. The present general math course, at the ninth grade level, is pretty much a review of the seventh and eighth grade plus several other uninteresting topics such as taxes, social security, the reading of light and water meters, and budgeting of money. High school freshmen are bored to tears with this kind of mathematics for they see no great need for it. Unfortunately, they soon begin

to hate mathematics with a passion. If we are patient, many of these same students will have limited experiences with the labor market as they progress through school and soon begin to feel a "need" for math. They begin to realize that math, in some form, is necessary for most jobs. I submit that these same students, taking the same general math course but two or three years older and wiser, will be more interested because the course will meet some of their basic needs. To conclude, reversing the grade level at which general math is offered would do much to improve the program.

Having taken the administrators to task for their lack of understanding of general math, I will now turn to the teachers who have also shown very little inclination to lead the way in this field. As mentioned previously, large classes, a high rate of absenteeism, inadequate teaching aids and equipment, poor textbooks, and student behavioral problems are just some of the routine problems that confront the general math teacher. Consequently, it is no surprise that a teacher looks upon general math as something to be tolerated, a necessary evil. It is something that is considered temporary and as soon as an opportunity avails itself, the teacher will advance up to the college prep courses.

The problems of the general math teacher, thus far considered, have been quite explicit. I suspect that with an all-out effort on the part of administrators and teachers these problems could be corrected for they are not monumental. However, it is not all that easy for we have failed to consider the prestige and status problem which is implicit in the failure of most general math programs. What I am saying is that the teaching of general math is very hazardous to the "teaching ego". College prep courses, for example, are very rewarding for a teacher. Students go on to be successful in college, business, industry and many other fields of endeavor. Their parents praise the teacher at the local school ice-cream social or PTA meeting. Professional people of the community take time to personally thank the teacher for doing such an outstanding job of teaching their sons and daughters. Even the school board members and school administrators express their gratitude for a job well done. Conversely, what does the general math teacher expect from his group of students. He can expect some static from the administrator if he can't control a behavioral problem in the classroom. He can't though, expect words of praise at the ice cream social because in all probability the parents are not interested in ice cream nor are they interested in the PTA. So it is with the professional people in the community, the board members and the school administrators. In a degree conscious society, who has time to compliment the teacher who is

instrumental in helping a student become a successful plumber or carpenter. A marvelous paradox exists in our society. We do little, if anything, to encourage and prepare our young people for vocational and technical careers while at the same time we perpetually complain about the lack of services, quality and workmanship that exists throughout business and industry.

The status and prestige problem is elusive. Unlike a lack of equipment or textbooks it can't be solved by money alone. Many general math programs still fail after much time, effort, and money have been poured into them simply because the math teachers were just not prepared to give of themselves one hundred percent. General math, for many teachers, is an exercise in futility. One day of failure follows still another in a routine that not all teachers can live with. Any improvement in the general math program must take into consideration the issue of prestige and status for teachers are not going to support a program that they themselves do not believe in.

In conclusion, general mathematics, in any form, by any name, is an unwanted child. It has survived the "modern math" movement unchanged, and it would appear to have a built in resiliency to any other kind of change. Its future is indeed bleak.

Let us now turn to the most pressing issue at hand - the development and implementation of a vocational-technical mathematics curriculum on the secondary level which will meet the needs of those students who plan to enter vocational and technical fields. Consider for a moment the college prep math curriculum and the many successes it has enjoyed, which is not too surprising when we consider that strong leadership was provided by colleges and universities throughout the country as well as the National Science Foundation. Who will provide the strong leadership which is so necessary to develop the vocational-technical math curriculum? Obviously, it should be the vocational and technical institutions. Unfortunately, they have failed in this respect. They have not provided strong leadership nor have they in any sense been the guiding light for secondary schools. By default they have let college prep math courses over-run the secondary curriculums. All is not lost though for vocational and technical institutions are beginning to acknowledge the fact that if they wish to have better prepared students from the secondary schools, they will have to do something about it besides complain over a cup of coffee. Vocational-technical mathematics on the secondary level is an idea that has come of age. The question is no longer "Do you wish to have vocational-technical mathematics in your high school curriculum?" It is "When do you wish to have vocational-technical mathematics in your high school curriculum?"

For example, the Milwaukee Area Technical College will begin this September to conduct an in-service program "Technical Mathematics in Secondary Schools". It is sponsored by the National Science Foundation and is primarily designed for the secondary math teachers in District Nine. I shall quote from their descriptive brochure two of the objectives of this in-service program.

One: To acquaint the participants with the type of mathematical understandings and skills needed in industrial and health services technician-training programs, and in related training programs for apprentices, tradesmen, and health services personnel.

Two: To encourage the participants to consider the addition to their curriculum of a mathematics sequence in grades 11 and 12 for students who intend to enroll in a post-high-school program at a vocational-technical college.

I will conclude by listing a few characteristics which I believe should be considered if we in District Fifteen are serious about developing a comprehensive vocational-technical math curriculum.

One: General mathematics must be sentenced to oblivion. Its dual objective of serving both the remedial and non-college bound student is an impossibility. It does neither

very well. Any comprehensive vocational-technical math program must exclude remedial mathematics. If this is not done, we will still have the same animal but will have given it another name.

Two: Vocational-technical math must never be considered the complement of college prep math for that is precisely how general math fell into ill repute. Vocational technical math will serve the students who are interested in vocational and technical fields. It is not remedial math and is not designed to meet the needs of remedial students.

Three: The vocational-technical math program must be sequential in nature just as is the college prep program. A fragmentary offering of courses, such as now being done in some of the schools in District Fifteen, will not adequately prepare students for vocational and technical institutions.

Four: A watered-down or slowed-down version of the math used in the college prep program is not appropriate. Vocational and technical students needs are met by utilitarian mathematics. They should not be forced through a rigorous and sophisticated theory-oriented college prep program.

Five: Require all students to have at least two years of mathematics but not necessarily two credits. It is realized that some of them do not get beyond the remedial stages of mathematics. All students should be encouraged to take a math course in their last year at school.

Six: A full year of formal geometry is not necessary nor is it desirable for a vocational-technical program. An integrated course of algebra and geometry along with basic fundamentals of the slide rule could be considered as its replacement.

Seven: We must be flexible in the development of a vocational-technical program and utmost consideration must be given to the establishment of semester courses and classes that do not meet every day. For example, the problem of remedial math, a class that should not meet every day throughout the school year, could be solved by having it meet every other day and interspersing it with a semester vocational-technical math course.

The development of a comprehensive vocational-technical program, contrary to what some teachers might think, will not be the ruination of the college prep program. Teachers who are happy with the status quo, in particular those who are presently teaching the college prep courses, need not fear having

their courses watered down nor do they have to be concerned with an influx of less capable students. With the addition of a vocational-technical mathematics program the entire math curriculum will be broadened and consequently the students can be more selective in their courses. As of now, many students are in college prep classes not because they plan to go to college but because they feel that general math just doesn't prepare them adequately for anything in particular.

I am tempted to write that vocational-technical math will be the second great revolution in mathematics within two decades. However, since so many good parents and educators have not recovered from the first, I shall remain silent. Suffice to say that vocational-technical mathematics is finally making serious in-roads into the college prep oriented courses.

In conclusion, a comprehensive vocational-technical mathematics program can and should be developed at the earliest date possible. Let us, NCTI and the secondary schools of District Fifteen, not have a "wait and see" attitude for if we are to be successful in our endeavor, we ourselves must develop this program. Let us not look for a convenient scapegoat for our present failures in general math for we are all responsible

to some degree. Let us, with aid of the Department of Public Instruction, other institutions of higher learning, business, and industry, begin to develop a comprehensive math program which will meet the needs of those students who plan to enter vocational and technical fields.

GLOSSARY

General Mathematics The term general mathematics will be used in the traditional sense, that is, all mathematics in the curriculum that is not considered college prep math.

Vocational-technical Mathematics This term shall denote a sequence of math courses designed specifically for students who are vocational and technically oriented. It is, by its very nature, primarily utilitarian mathematics, and does not include remedial mathematics.

Successful Students Successful students at NCTI are those that completed the math survey form and are in the third and fourth semester of a two year program or the second semester of a one year program.

The terms program and curriculum when in reference to mathematics are used interchangeably throughout the study.

APPENDIX A

Results of High School Mathematics Profile Survey

NOTE: In each column the first figure indicates the number of students that completed a particular course, and the second figure indicates the percent which is based on the number of seniors that completed the survey.

SCHOOL	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
ABBOTSFORD								
NO COURSE			16	34	23	49	25	53
ALGEBRA I	34	72	5	11	2	4		
ALGEBRA II					22	47	1	2
ALGEBRA II & TRIG								
TRIGONOMETRY								
PLANE GEOMETRY			26	55				
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY							17	36
GENERAL MATH	13	28						
BUSINESS MATH							4	9
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS								
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
47	47	I

SCHOOL ANTIGO SENIOR HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	28	11	84	32	174	66	223	84
ALGEBRA I	165	63	19	7	8	3	2	1
ALGEBRA II					2	1	1	
ALGEBRA II & TRIG					64	24	9	3
TRIGONOMETRY								
PLANE GEOMETRY	1		132	50	12	5	2	1
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY			1					
GENERAL MATH	64	24	14	5			1	
BUSINESS MATH	6	2	13	5	4	2	4	2
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS			1				22	8
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
332	264	1

SCHOOL ATHENS HIGH SCHOOL	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE			25	40	41	65	53	84
ALGEBRA I	50	79	1	2				
ALGEBRA II			22	35				
ALGEBRA II & TRIG								
TRIGONOMETRY								
PLANE GEOMETRY			15	24	21	33	4	6
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	13	21						
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							5	8
OTHER								

No. Seniors	No. Replies	Math Requirements for Graduation
70	63	1

SCHOOL COLBY PUBLIC SCHOOLS	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	2	2	24	22	65	59	98	89
ALGEBRA I	90	82	11	10				
ALGEBRA II					41	37	2	2
ALGEBRA II & TRIG								
TRIGONOMETRY								
PLANE GEOMETRY			74	67	4	4		
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	18	16	1	1				
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							10	9
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
115	110	1

SCHOOL D. C. EVEREST	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	6	3	85	46	100	54	124	67
ALGEBRA I	104	57	28	15	5	3	4	2
ALGEBRA II					40	22	11	6
ALGEBRA II & TRIG								
TRIGONOMETRY							1	1
PLANE GEOMETRY			66	36	16	9	7	4
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	74	40	4	2				
BUSINESS MATH			1	1	23	13	18	10
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							19	10
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
262	184	1

SCHOOL EDGAR	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	3	8	10	25	17	43	24	60
ALGEBRA I	32	80	2	5	1	3		
ALGEBRA II			1	3	20	50	2	5
ALGEBRA II & TRIG								
TRIGONOMETRY								
PLANE GEOMETRY			27	68	2	5	1	3
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY							12	30
GENERAL MATH	5	13					1	3
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS								
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
76	40	0

SCHOOL	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
LOYAL HIGH								
NO COURSE	2	3	31	44	33	47	23	33
ALGEBRA I	37	53	10	14	1	1		
ALGEBRA II			1	1	19	27	4	6
ALGEBRA II & TRIG					1	1		
TRIGONOMETRY								
PLANE GEOMETRY			27	39	15	21		
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY							14	20
GENERAL MATH	31	44	1	1	1	1		
BUSINESS MATH							29	41
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS								
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
88	70	1

SCHOOL MARATHON HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE			23	32	52	71	49	67
ALGEBRA I	44	60	18	25				
ALGEBRA II			31	42	1	1		
ALGEBRA II & TRIG								
TRIGONOMETRY								
PLANE GEOMETRY			1	1	20	27	1	1
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY							9	12
GENERAL MATH	29	40						
BUSINESS MATH							14	19
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS								
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
77	73	1

SCHOOL MEDFORD SENIOR HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	4	2	72	39	119	65	147	80
ALGEBRA I	77	42	40	22	7	4		
ALGEBRA II					36	20	8	4
ALGEBRA II & TRIG								
TRIGONOMETRY								
PLANE GEOMETRY			62	34	19	10	3	2
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY							21	11
GENERAL MATH	103	56	2	1	1	1		
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS			8	4				
OTHER					2	1	5	3

No. Seniors	No. Replies	Math. Requirements for Graduation
208	184	1

SCHOOL MERRILL SENIOR HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	1		76	31	158	64	215	87
ALGEBRA I	139	56	64	26	6	2	4	2
ALGEBRA II								
ALGEBRA II & TRIG			2	1	56	23	8	3
TRIGONOMETRY								
PLANE GEOMETRY			105	43	27	11	2	1
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY							18	7
GENERAL MATH	107	43						
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS								
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
275	247	1

SCHOOL MOSINEE HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	2	2	52	44	72	61	83	70
ALGEBRA I	59	50	20	17	8	7	2	2
ALGEBRA II	1	1					1	1
ALGEBRA II & TRIG					30	25	9	8
TRIGONOMETRY								
PLANE GEOMETRY			44	37	8	7	2	2
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	56	47	1	1			1	1
BUSINESS MATH			1	1				
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS								
OTHER							20	17

No. Seniors	No. Replies	Math. Requirements for Graduation
128	118	I

SCHOOL NEWMAN	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	3	2	6	5	36	28	77	61
ALGEBRA I	106	83	9	7	2	2		
ALGEBRA II								
ALGEBRA II & TRIG			3	2	71	56	4	3
TRIGONOMETRY							1	1
PLANE GEOMETRY	2	2	101	80	6	5	1	1
ANALYTIC GEOMETRY			1	1				
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	17	13	1	1				
BUSINESS MATH			7	6	11	9	5	4
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS					2	2	39	31
OTHER							1	1

No. Seniors	No. Replies	Math. Requirements for Graduation
162	127	2

SCHOOL PARK FALLS HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	3	3	30	33	51	55	64	70
ALGEBRA I	65	71	11	12	6	7	1	1
ALGEBRA II								
ALGEBRA II & TRIG								
TRIGONOMETRY					1	1		
PLANE GEOMETRY			51	55	4	4	4	4
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY					30	33	2	2
GENERAL MATH	24	26						
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							21	23
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
97	92	0

SCHOOL PHILLIPS HIGH SCHOOL	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	6	6	51	50	64	63	77	75
ALGEBRA I	62	61	4	4	5	5	4	4
ALGEBRA II					1	1		
ALGEBRA II & TRIG					22	22	6	6
TRIGONOMETRY								
PLANE GEOMETRY			41	40	7	7	4	4
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	22	22	4	4	1	1		
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							9	9
OTHER	10	10						

No. Seniors	No. Replies	Math. Requirements for Graduation
104	102	1

SCHOOL RIB LAKE HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	1	2	19	32	37	63	37	63
ALGEBRA I	41	69	7	12	1	2	3	5
ALGEBRA II					19	32	3	5
ALGEBRA II & TRIG								
TRIGONOMETRY								
PLANE GEOMETRY			33	56	2	3	2	3
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY							14	24
GENERAL MATH	17	29						
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS								
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
59	59	1

SCHOOL ROSHOLT	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	3	7	35	85	22	54	16	39
ALGEBRA I	27	66	2	5	5	12		
ALGEBRA II			2	5	11	27		
ALGEBRA II & TRIG								
TRIGONOMETRY								
PLANE GEOMETRY			1	2	3	7	2	5
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	11	27	1	2				
BUSINESS MATH							21	51
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							2	5
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
44	41	2

SCHOOL SHAWNO HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	10	5	40	21	88	47	105	56
ALGEBRA I	128	68	25	13	4	2	1	1
ALGEBRA II			64	34	45	24	11	6
ALGEBRA II & TRIG					1	1		
TRIGONOMETRY								
PLANE GEOMETRY			48	26	47	25	2	1
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY					1	1	20	11
GENERAL MATH	49	26	8	4				
BUSINESS MATH			1	1			27	14
SHOP MATH								
PROBABILITY & STATISTICS			1	1				
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							8	4
OTHER					1	1	13	7

No. Seniors	No. Replies	Math. Requirements for Graduation
230	187	1

SCHOOL STRATFORD	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE			10	14	47	64	63	86
ALGEBRA I	61	84	7	10				
ALGEBRA II								
ALGEBRA II & TRIG			2	3	23	32	1	1
TRIGONOMETRY								
PLANE GEOMETRY			54	74	3	4		
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	12	16						
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							9	12
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
90	73	1

SCHOOL WAUSAU EAST HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	15	6	61	26	110	46	163	68
ALGEBRA I	173	73	23	10	5	2		
ALGEBRA II			19	8	81	34	13	5
ALGEBRA I' & TRIG			1					
TRIGONOMETRY								
PLANE GEOMETRY	15	6	124	52	19	8	4	2
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	32	13	4	2	1			
BUSINESS MATH	1		4	2	6	3	4	2
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							51	21
OTHER					14	6	1	

No. Seniors	No. Replies	Math. Requirements for Graduation
340	238	1

SCHOOL WAUSAU WEST HIGH	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	14	5	116	43	155	57	201	74
ALGEBRA I	179	66	31	11	11	4	3	1
ALGEBRA II			9	3	76	28	23	8
ALGEBRA II & TRIG					1		1	
TRIGONOMETRY								
PLANE GEOMETRY	11	4	120	44	31	11	10	4
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY			1					
GENERAL MATH	74	27	10	4	2	1	4	1
BUSINESS MATH			1		7	3	10	4
SHOP MATH					1			
PROBABILITY & STATISTICS	1							
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							35	13
OTHER					4	1		

No. Seniors	No. Replies	Math. Requirements for Graduation
400	272	1

SCHOOL WITTENBERG-BIRNAMWOO	GRADE 9		GRADE 10		GRADE 11		GRADE 12	
NO COURSE	7	8	37	44	56	67	56	67
ALGEBRA I	50	60	12	14	3	4	2	2
ALGEBRA II								
ALGEBRA II & TRIG			1	1	19	23	5	6
TRIGONOMETRY								
PLANE GEOMETRY			33	39	6	7		
ANALYTIC GEOMETRY								
TRIG & ANALYTIC GEOMETRY								
GENERAL MATH	27	32	1	1			7	8
BUSINESS MATH								
SHOP MATH								
PROBABILITY & STATISTICS								
COMPUTER MATH								
LINEAR ALGEBRA								
INTRODUCTORY ANALYSIS							14	17
OTHER								

No. Seniors	No. Replies	Math. Requirements for Graduation
111	84	1

APPENDIX B

High School Mathematics Profile
Survey Form

This survey form was completed by 2675 of 3315 seniors in the twenty-one high schools that participated in the study. This represents approximately 81 percent of the entire group.

North Central Technical Institute
Research and Development

MATHEMATICS PROFILE SURVEY

Name _____ School _____

Please indicate in the spaces below the number of the course you successfully completed (Grade D or better) during your past four years in school. Place a ZERO in the blank if no course was taken for a particular year.

Nine	Ten	Eleven	Twelve
_____	_____	_____	_____

0	No course	8	General math
1	Algebra one	9	Business math
2	Algebra two	10	Shop math
3	Algebra two & trig	11	Probability & Statistics
4	Trigonometry	12	Computer math
5	Plane geometry	13	Linear algebra
6	Analytic geometry	14	Introductory analysis
7	Trig & Analytic Geometry	15	Other - please indicate

Place an * next to the number if it was a semester course.

WHAT ARE YOUR PLANS AFTER GRADUATION?

Please check one of the following:

a. Seek full time employment _____

b. Military service _____

c. Continue education

4 year college _____

2 year college or university center _____

technical institute _____

other (ex-business school, beauty school) _____

d. Homemaker _____

e. Plans not definite _____

f. Other _____

THANK YOU - YOUR COOPERATION IS VERY MUCH APPRECIATED.

APPENDIX C

NCTI Mathematics Survey

This survey form was completed by 300 students at NCTI. They represent third and fourth semester students in two year programs, and second semester students in one year programs.

NORTH CENTRAL TECHNICAL INSTITUTE
MATHEMATICS SURVEY

Name _____

Course _____

Major _____

Program (check one)

Associate Degree _____ Semester _____ Diploma _____ Semester _____

High School Graduate Yes _____ No _____

Prep Algebra Yes _____ No _____

Prep Arithmetic Yes _____ No _____

High School Courses (check)

Algebra I _____

Geometry _____

Algebra II _____

Other (please indicate)_____

Other post graduate math courses

_____

_____

_____

APPENDIX D

Number of students and per cent of those students who had "exactly" one, two and three courses of math.

Schools are grouped by their senior enrollment. The increment of each group is 150 students. Group one, 0 to 150 students; Group two, 151 to 300 students; Group three, 301 or more students.

SCHOOL	STUDENTS WITH 1 MATH COURSE		STUDENTS WITH 2 MATH COURSES		STUDENTS WITH 3 MATH COURSES	
	NO.	PCNT	NO.	PCNT	NO.	PCNT
BBOTSFORD	12	26	10	21	8	17
THENS HIGH SCHOOL	17	27	29	46	12	19
OLBY PUBLIC SCHOOLS	23	21	43	39	34	31
OGAR	8	20	10	25	9	23
OYAL HIGH	3	4	32	46	16	23
ARATHON HIGH	13	18	34	47	17	23
OSINEE HIGH	39	33	35	30	22	19
ARK FALLS HIGH	19	21	38	41	12	13
HILLIPS HIGH SCHOOL	41	41	28	28	22	22
IB LAKE HIGH	14	24	22	37	8	14
OSHOLT	2	5	32	78	6	15
TRATFORD	10	14	36	49	18	25
ITTENBERG-BIRNAMWOO	30	36	28	33	10	12
TOTALS	231	24	377	39	194	20

SCHOOL	STUDENTS WITH 1 MATH COURSE NO.	PCNT	STUDENTS WITH 2 MATH COURSES NO.	PCNT	STUDENTS WITH 3 MATH COURSES NO.	PCNT
C. EVEREST	37	20	81	44	42	23
DFORD SENIOR HIGH	59	32	66	36	33	18
RRILL SENIOR HIGH	64	26	99	40	60	24
NMAN	1	1	33	26	52	41
AWNO HIGH	19	10	60	32	64	34
TOTALS	180	19	339	36	251	27

SCHOOL	STUDENTS WITH 1 MATH COURSE		STUDENTS WITH 2 MATH COURSES		STUDENTS WITH 3 MATH COURSES	
	NO.	PCNT	NO.	PCNT	NO.	PCNT
TIGO SENIOR HIGH	86	33	94	36	61	23
USAU EAST HIGH	44	19	74	31	64	27
USAU WEST HIGH	70	24	93	32	85	30
TOTALS	200	25	261	33	210	27

APPENDIX E

Average math preparation and per cent of those students indicating an interest in four year college, technical institute or seek employment. Per cents are based on number of returns from each particular school.

Schools are grouped by their senior enrollment. The increment of each group is 150 students. Group one, 0 to 150 students; Group two, 151 to 300 students; Group three, 301 or more students.

SCHOOL	TOTAL SENIORS ENROLLED	4 YEAR COLLEGE No.	PCNT	AVERAGE MATH PREPARATION	TECHNICAL INSTITUTE NO.	PCNT	AVERAGE MATH PREPARATION	SEEK EMPLOYMENT NO.	PCNT	AVERAGE MATH PREPARATION
Abbotsford	47	18	38	3.6	3	6	2.7	13	28	1.5
Athens High School	70	12	19	2.7	9	14	2.1	19	30	1.7
Colby Public Schools	115	20	18	3.1	25	23	2.5	36	33	1.9
Edgar	76	15	38	3.3	9	23	2.7	7	18	1.7
Loyal High	88	18	26	3.1	23	33	2.7	5	7	1.8
Marathon High	77	11	15	3.4	15	21	2.5	24	33	1.9
Mosinee High	128	27	23	3.2	24	20	2.0	31	26	1.6
Park Falls High	97	19	21	3.5	19	21	2.4	30	33	1.9
Phillips High School	104	36	36	2.8	20	20	2.0	22	22	1.1
Rib Lake High	59	11	19	3.4	6	10	2.7	18	31	1.8
Rosholt	44	5	12	2.6	5	12	2.2	10	24	2.2
Stratford	90	17	23	2.8	14	19	2.5	18	25	2.1
Wittenberg-Birnamwood	111	18	21	3.3	11	13	1.9	29	35	1.6
FINAL TOTALS AND TOTAL AVERAGES -	1106	227	23	3.1	183	19	2.3	262	27	1.7

SCHOOL	TOTAL SENIORS ENROLLED	4 YEAR COLLEGE No.	PCNT	AVERAGE MATH PREPARATION	TECHNICAL INSTITUTE NO.	PCNT	AVERAGE MATH PREPARATION	SEEK EMPLOYMENT NO.	PCNT	AVERAGE MATH PREPARATION
D. C. Everest	262	38	21	2.8	34	18	2.3	48	26	2.0
Medford Senior High	208	32	17	3.3	36	20	2.2	38	21	1.6
Merrill Senior High	275	53	21	2.9	33	13	2.4	68	28	1.6
Newman	162	59	46	3.3	11	9	3.2	14	11	2.4
Shawano High	230	70	37	3.2	27	14	2.8	41	22	2.1
FINAL TOTALS AND TOTAL AVERAGES	1137	252	27	3.1	141	15	2.5	209	22	1.9

SCHOOL	TOTAL SENIORS ENROLLED	4 YEAR COLLEGE No.	PCNT	AVERAGE MATH PREPARATION	TECHNICAL INSTITUTE NO.	PCNT	AVERAGE MATH PREPARATION	SEEK EMPLOYMENT NO.	PCNT	AVERAGE MATH PREPARATION
Antigo Senior High	332	78	30	2.9	34	13	1.9	61	23	1.6
Wausau East High	340	104	44	3.0	16	7	2.3	29	12	1.6
Wausau West High	400	79	27	3.0	37	13	2.1	57	20	1.7
FINAL TOTALS AND TOTAL AVERAGES	1072	261	33	3.0	87	11	2.0	147	19	1.6